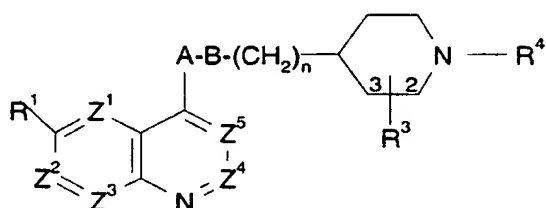


# Claims

1. A method of treatment of bacterial infections in mammals, which method comprises the administration to a mammal in need of such treatment of an effective amount of a compound of formula (I) or a pharmaceutically acceptable derivative thereof:



(I)

wherein:

one of Z<sup>1</sup>, Z<sup>2</sup>, Z<sup>3</sup>, Z<sup>4</sup> and Z<sup>5</sup> is N or CR<sup>1a</sup> and the remainder are CH;

R<sup>1</sup> is selected from hydroxy; (C<sub>1-6</sub>) alkoxy optionally substituted by (C<sub>1-6</sub>)alkoxy, amino, piperidyl, guanidino or amidino optionally N-substituted by one or two (C<sub>1-6</sub>)alkyl, acyl or (C<sub>1-6</sub>)alkylsulphonyl groups, NH<sub>2</sub>CO, hydroxy, thiol, (C<sub>1-6</sub>)alkylthio, heterocyclylthio, heterocyclyloxy, arylthio, aryloxy, acylthio, acyloxy or (C<sub>1-6</sub>)alkylsulphonyloxy; (C<sub>1-6</sub>)alkoxy-substituted (C<sub>1-6</sub>)alkyl; halogen; (C<sub>1-6</sub>)alkyl; (C<sub>1-6</sub>)alkylthio; trifluoromethyl; nitro; azido; acyl; acyloxy; acylthio; (C<sub>1-6</sub>)alkylsulphonyl; (C<sub>1-6</sub>)alkylsulphoxide; arylsulphonyl; arylsulphoxide or an amino, piperidyl, guanidino or amidino group optionally N-substituted by one or two (C<sub>1-6</sub>)alkyl, acyl or (C<sub>1-6</sub>)alkylsulphonyl groups, or when one of Z<sup>1</sup>, Z<sup>2</sup>, Z<sup>3</sup>, Z<sup>4</sup> and Z<sup>5</sup> is N, R<sup>1</sup> may instead be hydrogen;

R<sup>1a</sup> is selected from hydrogen and the groups listed above for R<sup>1</sup>;

R<sup>3</sup> is in the 2- or 3-position and is:

carboxy; (C<sub>1-6</sub>)alkoxycarbonyl; aminocarbonyl wherein the amino group is optionally substituted by hydroxy, (C<sub>1-6</sub>)alkyl, hydroxy(C<sub>1-6</sub>)alkyl, aminocarbonyl(C<sub>1-6</sub>)alkyl, (C<sub>2-6</sub>)alkenyl, (C<sub>1-6</sub>)alkylsulphonyl, trifluoromethylsulphonyl, (C<sub>1-6</sub>)alkenylsulphonyl, (C<sub>1-6</sub>)alkoxycarbonyl, (C<sub>1-6</sub>)alkylcarbonyl, (C<sub>2-6</sub>)alkenyloxycarbonyl or (C<sub>2-6</sub>)alkenylcarbonyl and optionally further substituted by (C<sub>1-6</sub>)alkyl, hydroxy(C<sub>1-6</sub>)alkyl, aminocarbonyl(C<sub>1-6</sub>)alkyl or (C<sub>2-6</sub>)alkenyl; cyano; tetrazolyl; 2-oxo-oxazolidinyl optionally substituted by R<sup>10</sup>; 3-hydroxy-3-cyclobutene-1,2-dione-4-yl; 2,4-

thiazolidinedione-5-yl; tetrazol-5-ylaminocarbonyl; 1,2,4-triazol-5-yl optionally substituted by R<sup>10</sup>; or 5-oxo-1,2,4-oxadiazol-3-yl; or

R<sup>3</sup> is in the 2- or 3-position and is (C<sub>1-4</sub>)alkyl or ethenyl substituted with any of the groups listed above for R<sup>3</sup> and 0 to 2 groups R<sup>12</sup> independently selected from:

- 5        thiol; halogen; (C<sub>1-6</sub>)alkylthio; trifluoromethyl; azido; (C<sub>1-6</sub>)alkoxycarbonyl; (C<sub>1-6</sub>)alkylcarbonyl; (C<sub>2-6</sub>)alkenyloxycarbonyl; (C<sub>2-6</sub>)alkenylcarbonyl; hydroxy optionally substituted by (C<sub>1-6</sub>)alkyl, (C<sub>2-6</sub>)alkenyl, (C<sub>1-6</sub>)alkoxycarbonyl, (C<sub>1-6</sub>)alkylcarbonyl, (C<sub>2-6</sub>)alkenyloxycarbonyl, (C<sub>2-6</sub>)alkenylcarbonyl or aminocarbonyl wherein the amino group is optionally substituted by (C<sub>1-6</sub>)alkyl, (C<sub>2-6</sub>)alkenyl, (C<sub>1-6</sub>)alkylcarbonyl or (C<sub>2-6</sub>)alkenylcarbonyl; amino optionally mono- or disubstituted by
- 10        (C<sub>1-6</sub>)alkoxycarbonyl, (C<sub>1-6</sub>)alkylcarbonyl, (C<sub>2-6</sub>)alkenyloxycarbonyl, (C<sub>2-6</sub>)alkenylcarbonyl, (C<sub>1-6</sub>)alkyl, (C<sub>2-6</sub>)alkenyl, (C<sub>1-6</sub>)alkylsulphonyl, (C<sub>2-6</sub>)alkenylsulphonyl or aminocarbonyl wherein the amino group is optionally substituted by (C<sub>1-6</sub>)alkyl or (C<sub>2-6</sub>)alkenyl; aminocarbonyl wherein the amino group is optionally
- 15        substituted by (C<sub>1-6</sub>)alkyl, hydroxy(C<sub>1-6</sub>)alkyl, aminocarbonyl(C<sub>1-6</sub>)alkyl, (C<sub>2-6</sub>)alkenyl, (C<sub>1-6</sub>)alkoxycarbonyl, (C<sub>1-6</sub>)alkylcarbonyl, (C<sub>2-6</sub>)alkenyloxycarbonyl or (C<sub>2-6</sub>)alkenylcarbonyl and optionally further substituted by (C<sub>1-6</sub>)alkyl, hydroxy(C<sub>1-6</sub>)alkyl, aminocarbonyl(C<sub>1-6</sub>)alkyl or (C<sub>2-6</sub>)alkenyl; oxo; (C<sub>1-6</sub>)alkylsulphonyl; (C<sub>2-6</sub>)alkenylsulphonyl; or (C<sub>1-6</sub>)aminosulphonyl wherein the amino group is optionally
- 20        substituted by (C<sub>1-6</sub>)alkyl or (C<sub>2-6</sub>)alkenyl; provided that when R<sup>3</sup> is disubstituted with hydroxy or amino and carboxy containing substituents these may optionally together form a cyclic ester or amide linkage, respectively;
- 25        and provided that R<sup>3</sup> is other than (C<sub>1-4</sub>)alkyl or ethenyl substituted by (C<sub>1-6</sub>)alkoxycarbonyl or aminocarbonyl optionally substituted by (C<sub>1-6</sub>)alkyl, (C<sub>2-6</sub>)alkenyl, (C<sub>1-6</sub>)alkoxycarbonyl, (C<sub>1-6</sub>)alkylcarbonyl, (C<sub>2-6</sub>)alkenyloxycarbonyl or (C<sub>2-6</sub>)alkenylcarbonyl and optionally further substituted by (C<sub>1-6</sub>)alkyl, hydroxy(C<sub>1-6</sub>)alkyl, aminocarbonyl(C<sub>1-6</sub>)alkyl or (C<sub>2-6</sub>)alkenyl and 0 to 2 groups R<sup>12</sup>;
- 30        wherein R<sup>10</sup> is selected from (C<sub>1-4</sub>)alkyl; (C<sub>2-4</sub>)alkenyl; aryl; a group R<sup>12</sup> as defined above; carboxy; aminocarbonyl wherein the amino group is optionally substituted by hydroxy, (C<sub>1-6</sub>)alkyl, (C<sub>2-6</sub>)alkenyl, (C<sub>1-6</sub>)alkylsulphonyl, trifluoromethylsulphonyl, (C<sub>1-6</sub>)alkenylsulphonyl, (C<sub>1-6</sub>)alkoxycarbonyl, (C<sub>1-6</sub>)alkylcarbonyl, (C<sub>2-6</sub>)alkenyloxycarbonyl or (C<sub>2-6</sub>)alkenylcarbonyl and optionally further substituted by (C<sub>1-6</sub>)alkyl or (C<sub>2-6</sub>)alkenyl; cyano; or tetrazolyl;
- 35

R<sup>4</sup> is a group -CH<sub>2</sub>-R<sup>5</sup> in which R<sup>5</sup> is selected from:

(C<sub>3-12</sub>)alkyl; hydroxy(C<sub>3-12</sub>)alkyl; (C<sub>1-12</sub>)alkoxy(C<sub>3-12</sub>)alkyl; (C<sub>1-12</sub>)alkanoyloxy(C<sub>3-12</sub>)alkyl; (C<sub>3-6</sub>)cycloalkyl(C<sub>3-12</sub>)alkyl; hydroxy-, (C<sub>1-12</sub>)alkoxy- or (C<sub>1-12</sub>)alkanoyloxy-(C<sub>3-6</sub>)cycloalkyl(C<sub>3-12</sub>)alkyl; cyano(C<sub>3-12</sub>)alkyl; (C<sub>2-12</sub>)alkenyl; (C<sub>2-12</sub>)alkynyl; tetrahydrofuryl; mono- or di-(C<sub>1-12</sub>)alkylamino(C<sub>3-12</sub>)alkyl; acylamino(C<sub>3-12</sub>)alkyl; (C<sub>1-12</sub>)alkyl- or acyl-aminocarbonyl(C<sub>3-12</sub>)alkyl; mono- or di-(C<sub>1-12</sub>)alkylamino(hydroxy) (C<sub>3-12</sub>)alkyl; optionally substituted phenyl(C<sub>1-2</sub>)alkyl, phenoxy(C<sub>1-2</sub>)alkyl or phenyl(hydroxy)(C<sub>1-2</sub>)alkyl; optionally substituted diphenyl(C<sub>1-2</sub>)alkyl; optionally substituted phenyl(C<sub>2-3</sub>)alkenyl; optionally substituted benzoyl or benzoylmethyl; optionally substituted heteroaryl(C<sub>1-2</sub>)alkyl; and optionally substituted heteroaroyl or heteroaroylmethyl;

n is 0, 1 or 2;

either A-B is NHC(O)NH or NHC(O)O, or

A is NR<sup>11</sup>, O, S(O)<sub>x</sub> or CR<sup>6</sup>R<sup>7</sup> and B is NR<sup>11</sup>, O, S(O)<sub>x</sub> or CR<sup>8</sup>R<sup>9</sup> where x is 0, 1 or 2 and wherein:

each of R<sup>6</sup> and R<sup>7</sup> R<sup>8</sup> and R<sup>9</sup> is independently selected from: H; thiol; (C<sub>1-6</sub>)alkylthio; halo; trifluoromethyl; azido; (C<sub>1-6</sub>)alkyl; (C<sub>2-6</sub>)alkenyl; (C<sub>1-6</sub>)alkoxycarbonyl; (C<sub>1-6</sub>)alkylcarbonyl; (C<sub>2-6</sub>)alkenyloxycarbonyl; (C<sub>2-6</sub>)alkenylcarbonyl; hydroxy, amino or aminocarbonyl optionally substituted as for corresponding substituents in R<sup>3</sup>; (C<sub>1-6</sub>)alkylsulphonyl; (C<sub>2-6</sub>)alkenylsulphonyl; or (C<sub>1-6</sub>)aminosulphonyl wherein the amino group is optionally substituted by (C<sub>1-6</sub>)alkyl or (C<sub>1-6</sub>)alkenyl; or R<sup>6</sup> and R<sup>8</sup> together represent a bond and R<sup>7</sup> and R<sup>9</sup> are as above defined; or R<sup>6</sup> and R<sup>8</sup> together represent -O- and R<sup>7</sup> and R<sup>9</sup> are both hydrogen; or R<sup>6</sup> and R<sup>7</sup> or R<sup>8</sup> and R<sup>9</sup> together represent oxo; and each R<sup>11</sup> is independently H, trifluoromethyl, (C<sub>1-6</sub>)alkyl, (C<sub>1-6</sub>)alkenyl, (C<sub>1-6</sub>)alkoxycarbonyl, (C<sub>1-6</sub>)alkylcarbonyl, aminocarbonyl wherein the amino group is optionally substituted by (C<sub>1-6</sub>)alkoxycarbonyl, (C<sub>1-6</sub>)alkylcarbonyl, (C<sub>1-6</sub>)alkenyloxycarbonyl, (C<sub>2-6</sub>)alkenylcarbonyl, (C<sub>1-6</sub>)alkyl or (C<sub>1-6</sub>)alkenyl and optionally further substituted by (C<sub>1-6</sub>)alkyl or (C<sub>1-6</sub>)alkenyl;

provided that A and B cannot both be selected from NR<sup>11</sup>, O and S(O)<sub>x</sub> and when one of A and B is CO the other is not CO, O or S(O)<sub>x</sub>.

2. A compound of formula (IA) or a pharmaceutically acceptable derivative thereof which is a compound of formula (I) as defined in claim 1 wherein  $R^3$  is other than  $(C_{1-6})$ alkoxycarbonyl; optionally substituted aminocarbonyl, CN or COOH.
3. A compound according to claim 2 wherein  $Z^5$  is CH or N and  $Z^1$ - $Z^4$  are each
- 5 CH.
4. A compound according to claim 2 or 3 wherein  $R^1$  is methoxy, amino- or  
 10 guanidino- $(C_{3-5})$ alkyloxy, guanidino $(C_{3-5})$ alkyloxy, piperidyl $(C_{3-5})$ alkyloxy, nitro or fluoro, and  $R^{1a}$  is hydrogen.
5. A compound according to any of claims 2 to 4 wherein  $R^3$  is in the 3-position and  
 10 is  $CH_2CO_2H$  or 2-oxo-oxazolidinyl.
6. A compound according to any of claims 2 to 5 wherein  $AB(CH_2)_n$  is  $(CH_2)_3$ .
7. A compound according to any of claims 2 to 6 wherein  $R^4$  is  $(C_{5-10})$ alkyl, unsubstituted phenyl $(C_{2-3})$ alkyl or unsubstituted phenyl $(C_{3-4})$ alkenyl.
8. A compound of formula (I) as defined in claim 1 selected from:
- 15 [3R, 4R]-1-Heptyl-3-(1-(R or S)-hydroxy-2-cyanoethyl)-4-[3-(6-methoxyquinolin-4-yl)propyl]piperidine;  
 [3R, 4R]-1-Heptyl-3-(2-(R or S)-oxo-oxazolidin-5-yl)-4-[3-(6-methoxyquinolin-4-yl)propyl] piperidine;  
 [3R, 4R]-1-Heptyl-3-(2-cyanoethyl)-4-[3-(6-methoxyquinolin-4-yl) propyl] piperidine;  
 20 [3R, 4R]-1-Heptyl-3-(3-carboxyethyl)-4-[3-(6-methoxyquinolin-4-yl) propyl] piperidine;  
 [3R, 4R]-1-Heptyl-3-carboxy-4-[3-(6-methoxyquinolin-4-yl) propyl] piperidine;  
 [3R, 4R]-1-Heptyl-3-(carboxymethyl)-4-[3-(6-methoxyquinolin-4-yl) propyl] piperidine;  
 [3R, 4R]-1-Heptyl-3-(1-(R or S)-hydroxy-2-carboxyethyl)-4-[3-(6-methoxyquinolin-4-yl)propyl]piperidine;  
 25 [3R, 4R]-1-Heptyl-3-(2-(E)-carboxyethenyl)-4-[3-(6-methoxyquinolin-4-yl)propyl]piperidine;  
 N-(cis-3-(R/S)-Ethoxycarbonyl-1-heptyl-4-(S/R)-piperidyl)-N'-(6-methoxyquinolin-4-yl)urea;  
 N-(cis-3-(R/S)-Ethoxycarbonyl-1-heptyl-4-(S/R)-piperidyl)-N'-(6-methoxy-[1,5]-  
 30 naphthyridin-4-yl)urea;  
 N-(cis-3-(R/S)-Aminocarbonyl-1-heptyl-4-(S/R)-piperidyl)-N'-(6-methoxy-[1,5]-naphthyridin-4-yl)urea;  
 [3R, 4R]-1-Heptyl-4-[3-(R/S)-hydroxy-3-(6-methoxyquinolin-4-yl)propyl]-3-(2-(R or S)-oxo-oxazolidin-5-yl)-piperidine;  
 35 [3R, 4R]-1-Heptyl-3-cyanomethyl-4-[3-(R/S)-hydroxy-3-(6-methoxyquinolin-4-yl)propyl]piperidine;

[3R, 4R]-1-Heptyl-3-cyanomethyl-4-(2-(R)-hydroxy-3-(6-methoxyquinolin-4-yl)propyl)piperidine;

N-(cis-3-(R/S)-Carboxy-1-heptyl-4-(S/R)-piperidyl)-N'-(6-methoxyquinolin-4-yl)urea;

cis-3-(R/S)-Ethoxycarbonyl-1-heptyl-4-(S/R)-(6-methoxyquinolin-4-yl)aminocarbonyloxypiperidine;

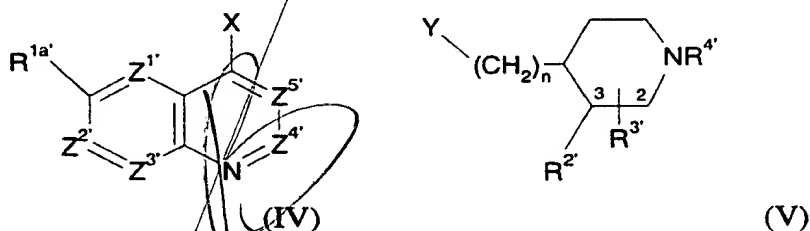
cis-3-(R/S)-Carboxy-1-heptyl-4-(S/R)-(6-methoxyquinolin-4-yl)aminocarbonyloxypiperidine;

a compound 18-36 from Table 1;

or a pharmaceutically acceptable derivative of any of the foregoing compounds.

9. A process for preparing compounds of formula (IA) as defined in claim 2, or a pharmaceutically acceptable derivative thereof, which process comprises:

(a) reacting a compound of formula (IV) with a compound of formula (V):



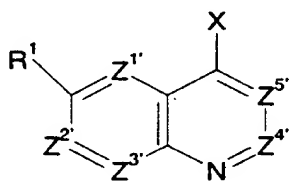
wherein  $Z^1$ ,  $Z^2$ ,  $Z^3$ ,  $Z^4$  and  $Z^5$ ,  $m$ ,  $n$ ,  $R^1$ ,  $R^2$ ,  $R^3$  and  $R^4$  are as defined in formula (I), and  $X$  and  $Y$  may be the following combinations:

- (i)  $X$  is  $M$  and  $Y$  is  $CH_2CO_2R^X$
- (ii)  $X$  is  $CO_2RY$  and  $Y$  is  $CH_2CO_2R^X$
- (iii) one of  $X$  and  $Y$  is  $CH=SPh_2$  and the other is  $CHO$
- (iv)  $X$  is  $CH_3$  and  $Y$  is  $CHO$
- (v)  $X$  is  $CH_3$  and  $Y$  is  $CO_2R^X$
- (vi)  $X$  is  $CH_2CO_2RY$  and  $Y$  is  $CO_2R^X$
- (vii)  $X$  is  $CH=PR^Z_3$  and  $Y$  is  $CHO$
- (viii)  $X$  is  $CHO$  and  $Y$  is  $CH=PR^Z_3$
- (ix)  $X$  is halogen and  $Y$  is  $CH=CH_2$
- (x) one of  $X$  and  $Y$  is  $COW$  and the other is  $NHR^{11'}$  or  $NCO$
- (xi) one of  $X$  and  $Y$  is  $(CH_2)_p-V$  and the other is  $(CH_2)_qNHR^{11'}$ ,  $(CH_2)_qOH$ ,  $(CH_2)_qSH$  or  $(CH_2)_qSCOR^X$  where  $p+q=1$
- (xii) one of  $X$  and  $Y$  is  $CHO$  and the other is  $NHR^{11'}$
- (xiii) one of  $X$  and  $Y$  is  $OH$  and the other is  $-CH=N_2$

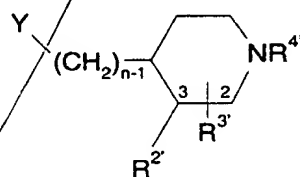
in which V and W are leaving groups,  $R^X$  and  $R^Y$  are  $(C_{1-6})$ alkyl and  $R^Z$  is aryl or  $(C_{1-6})$ alkyl, or

(xiv) X is NCO, Y is OH or  $NH_2$ ;

- 5 (b) reacting a compound of formula (IV) with a compound of formula (Vb):



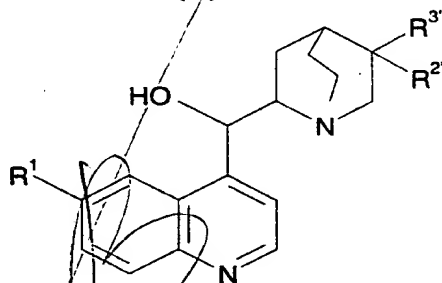
(IV)



(Vb)

- 10 wherein  $Z^1, Z^2, Z^3, Z^4$  and  $Z^5$ , m, n,  $R^1, R^2, R^3$  and  $R^4$  are as defined in formula (I), X is  $CH_2NHR^{11'}$  and Y is CHO or COW or X is  $CH_2OH$  and Y is  $-CH=N_2$ ;

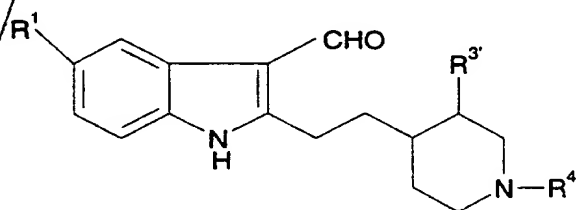
(c) rearranging a compound of formula (II):



(II)

- 15 to give a compound of formula (III) which is a compound of formula (I) where  $Z^1-Z^5$  are CH, n is 1, A-B is  $COCH_2$  and  $R^2$  is H, or a compound of formula (VII) which is a compound of formula (I) where n is 1, A-B is  $CHOHCH_2$  or  $CH_2CHOH$  and  $R^2$  is H; or

(d) photooxygenating a compound of formula (VI):



(VI)

20 in which  $Z^{1'}-Z^{5'}$  are  $Z^1-Z^5$  or groups convertible thereto,  $R^{11'}, R^1, R^{2'}, R^{3'}$  and  $R^{4'}$  are  $R^{11}, R^1, R^2, R^3$  and  $R^4$  or groups convertible thereto, and thereafter optionally or as

necessary converting  $R^{11'}$ ,  $R^{1'}$ ,  $R^{2'}$ ,  $R^{3'}$  and  $R^{4'}$  to  $R^{11}$ ,  $R^1$ ,  $R^2$ ,  $R^3$  and  $R^4$ , converting  $Z^{1'-Z^{5'}}$  to  $Z^1$ - $Z^5$ , converting A-B to other A-B, interconverting  $R^{11}$ ,  $R^1$ ,  $R^2$ ,  $R^3$  and/or  $R^4$  and forming a pharmaceutically acceptable derivative thereof.

- 5 10. A pharmaceutical composition comprising a compound of formula (IA) as defined in claim 2, or a pharmaceutically acceptable derivative thereof, and a pharmaceutically acceptable carrier.
11. The use of a compound of formula (I) as defined in claim 1 or a pharmaceutically acceptable derivative thereof in the manufacture of a medicament for use in the treatment
- 10 of bacterial infections in mammals.
12. A pharmaceutical composition for use in the treatment of bacterial infections in mammals comprising a compound of formula (I) as defined in claim 1, or a pharmaceutically acceptable derivative thereof, and a pharmaceutically acceptable carrier.

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